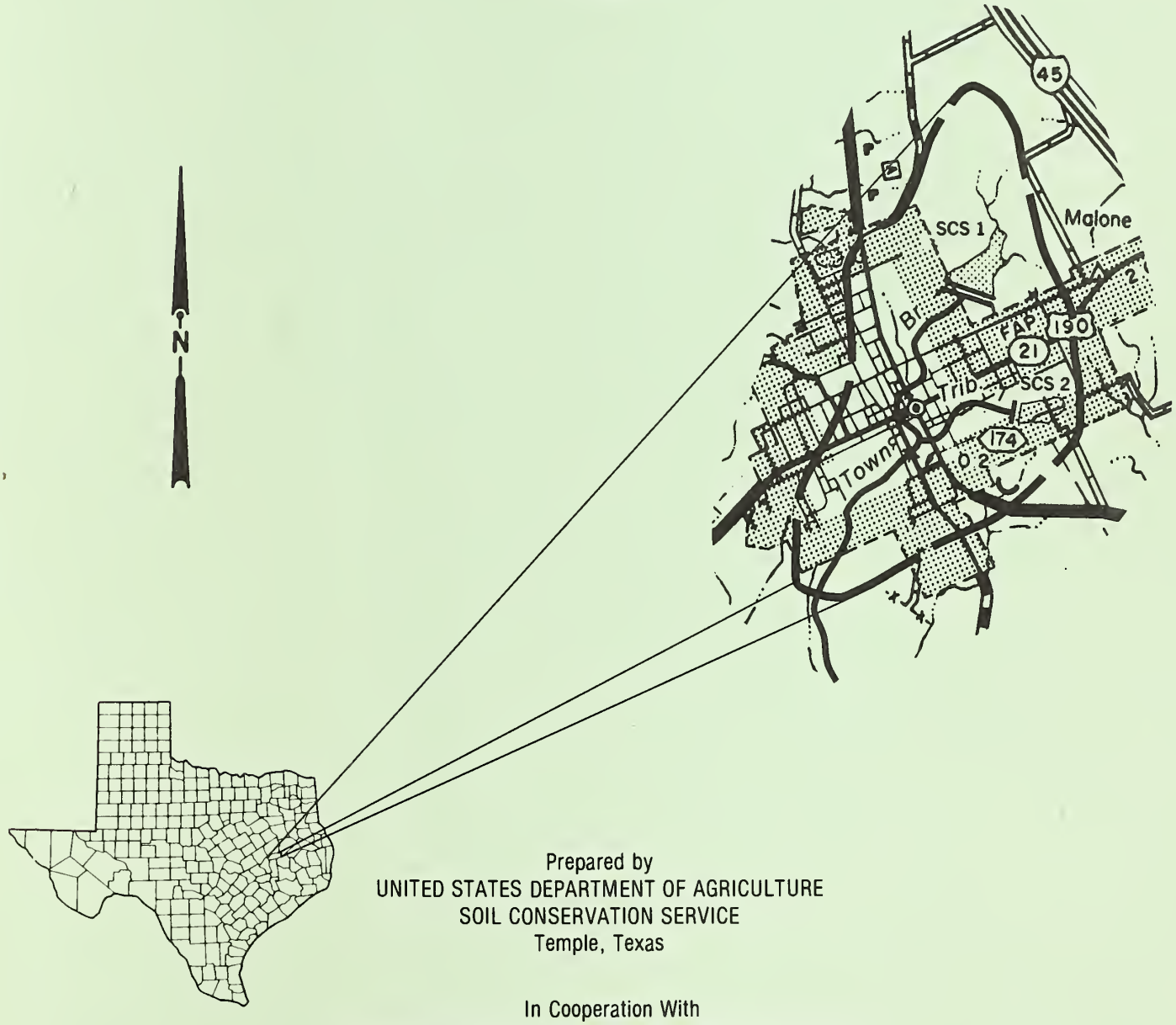
TOWN BRANCH AND TRIBUTARIES

FLOOD PLAIN MANAGEMENT STUDY
AND DAM BREACH STUDY
MADISON COUNTY, TEXAS



Prepared by
UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
Temple, Texas

In Cooperation With
BEDIAS CREEK SOIL AND WATER CONSERVATION DISTRICT
MADISON COUNTY COMMISSIONERS COURT
CITY OF MADISONVILLE
and the
TEXAS WATER COMMISSION

April 1988

FLOOD PLAIN MANAGEMENT STUDY,
DAM SAFETY BREACH ROUTINGS OF CONSTRUCTED DAMS
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FLOOD PLAIN MANAGEMENT STUDY

DAM SAFETY BREACH ROUTINGS OF CONSTRUCTED DAMS

TOWN BRANCH AND TRIBUTARIES

MADISON COUNTY, TEXAS

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INTRODUCTION

Town Branch Watershed is a lesser tributary of the Trinity River. It is located below the portion of the Trinity River Basin authorized for installation of flood prevention works of improvement under the Flood Control Act of December 22, 1944. A watershed plan was developed in October 1961 resulting in construction of one multi-purpose structure and a floodwater retarding structure in June 1972.

In April 1986 the City of Madisonville and the Madison County Commissioners Court passed resolutions requesting, through the Texas Water Commission (TWC), that the Soil Conservation Service (SCS) conduct a flood plain management study and breach analysis on Town Branch and Tributaries. The Bedias Creek Soil and Water Conservation District passed a resolution May 5, 1986, concurring in this request and recommended that the SCS make the study.

The assistance and cooperation given by the agencies, organizations and individuals during the City of Madisonville Flood Plain Management Study is greatly appreciated. These include:

Bedias Creek Soil and Water Conservation District

City of Madisonville

Madison County Commissioners Court

Special appreciation is extended to the individuals who contributed information for the study. Appreciation is also extended to the landowners who permitted access to their property for surveys, photographs, and reconnaissance.

The SCS conducts cooperative flood plain management studies in Texas through the November 1973 Joint Coordination Agreement (Revised 2/86) between the SCS and the Texas Water Commission. SCS assists state agencies and communities in the development, revision, and implementation of their flood plain management programs by carrying out cooperative flood plain management studies (FPMS's) in accordance with Federal Level Recommendation 3 of "A Unified National Program for Flood Plain Management," and Section 6 of the Public Law 83-566. The principles contained in Executive Order 11988, Flood Plain Management, are addressed in this part.

DESCRIPTION OF THE WATERSHED

Town Branch heads approximately 1.5 miles north of the town of Madisonville in Madison County and flows south and southwest through Madisonville to enter Caney Creek about 2 miles south of town. Caney Creek outlets into Bedias Creek, a tributary of the Trinity River. Several small unnamed tributaries flow into Town Branch. One of these flowing from the east has its point of junction within the city limit of Madisonville. The drainage area of the total watershed is 3.6 square miles. The study area is in Geological Survey Hydrologic Unit Number 12030202.

The topography of the watershed is gently to moderately rolling. Elevations range from 350 feet above mean sea level in the headwaters to 225 feet on the flood plain near Caney Creek.

NATURAL VALUES

CLIMAX VEGETATION

This watershed is located within the Post Oak Savannah Vegetational Area, described by F. W. Gould in Texas Plants - A Checklist and Ecological Summary.

Although some authorities place this vegetational area in the oak hickory forest association to the east, many classify the Post Oak Savannah as a true prairie association of the grassland formation. Upland mottes of post oak and blackjack oak were originally interspersed within grasslands of predominantly little bluestem, Indiangrass, switchgrass, purpletop, and Texas wintergrass. Water oak, green ash, sugarberry, and elms grew in the bottomlands along Town Branch and its tributaries.

LAND USE

This watershed comprises 2,300 acres. The current land use, by acres and percent of watershed are presented:

Land Use	Acres	Percent of Watershed
Urban	920	40.0
Pasture	842	36.6
Recreation	246	10.7
Woods	125	5.4
Impounded Water	107	4.7
Cropland	40	1.7
Range	20	0.9
	2,300	100.0

Coastal bermudagrass is the dominant introduced grass within the 842 acres of pasture. Common ragweed, soft gold aster, doveweed, silver-leafed nightshade and annual broomweed occur in many pastures due to varying levels of weed control and fertilization. Other introduced pasture grasses are common bermudagrass, bahiagrass, and Johnsongrass.

The city of Madisonville, centrally located within the watershed, comprises the majority of the urban acreage.

Range is randomly distributed throughout the watershed. Common herbaceous species in grazed areas are broomsedge bluestem, silver bluestem, threeawn, meadow dropseed and low panicums. Purpletop, little bluestem, dallisgrass, vaseygrass, and Indiangrass are found in ungrazed areas. Mesquite, persimmon and winged elm are scattered throughout.

Most of the 246 acres of recreation land is developed as a city park in association with Lake Madison (Site 1), a 76-acre multi-purpose structure built with assistance from the Soil Conservation Service. Recreational activities include boating, fishing, camping, swimming and picnicking.

Predominant trees in upland woods are post oak and blackjack oak typically found in scattered mottes. Water oak, green ash, pecan, sugarberry, and elm are prevalent in bottomlands and along stream courses. Yaupon is the most common understory woody species. Prickly ash, greenbriar, wild grapes, rattan, and eastern red cedar are found along fence rows.

The impounded water is located in Madison Lake; Site 2, another Soil Conservation Service floodwater retarding structure and about 60 farm ponds.

Most of the cropland is planted to oats and annual ryegrass for winter grazing.

PRIME FARMLAND SOILS

Less than 50 percent of the watershed area is currently mapped. The predominant soil series in the watershed are Zulch, Zack, and Tabor. The only prime farmland soil series mapped to date is Rader.

The Rader series consists of deep, moderately well drained, very slowly permeable soils located on nearly level to gently sloping terraces and uplands. The main use is grass production.

FISH AND WILDLIFE

Town Branch is of little recreational value because it is primarily an ephemeral stream with some semi-permanent pools in the lower reach. Minnows, darters, sunfish, and bullheads are found in these pools.

Lake Madison, a public fishing lake, has been stocked with largemouth bass, hybrid sunfish, channel and blue catfish, crappie, golden shiner, and threadfin shad.

Site 2 and farm ponds have been stocked with largemouth bass, bluegill, green sunfish, crappie, channel catfish, and fathead minnows.

Ducks, geese, kildeer, and mourning dove can be seen at lakes and farm ponds. Eastern meadow larks, scissortail flycatchers, sparrow hawks (kestrels), native sparrows, and crows are observed in open areas. Eastern kingbirds, loggerhead shrikes, brown thrashers, woodpeckers, owls, vireos, and warblers inhabit fence rows and woodlands. Cardinals, mockingbirds, purple martins, hummingbirds, robins, and house sparrows frequent residences in Madisonville.

Common mammals of the watershed are fox squirrels, raccoons, oppossums, skunks, small rodents, rabbits, and armadillos. White-tailed deer and beaver are occasionally observed around impounded water and along stream courses.

WETLANDS

Farm ponds comprise 28 acres of Type 5 wetland, described in the U.S. Fish and Wildlife Service Circular 39, "Wetlands of the United States." Type 5 wetland is predominantly open water bounded by shallow edges of emergent vegetation. Maximum water depths rarely reach 10 feet.

THREATENED AND ENDANGERED SPECIES

No plants from Madison County are listed as threatened or endangered by the U. S. Fish and Wildlife Service, Texas Parks and Wildlife Department, or Texas Organization for Endangered Species, according to its Publication No. 5 entitled "Endangered, Threatened and Watch Lists of Plants of Texas" dated March 1987.

No vertebrate animals are listed by the aforementioned organizations according to Texas Organization for Endangered Species' Publication No. 4 entitled "Endangered, Threatened and Watch Lists of Vertebrates of Texas" dated March 1984.

No plants and vertebrate animals from Madison County are listed in the Federal Register as threatened and endangered species.

PROCEDURES FOR ANALYSIS

SCS hydrologic and hydraulic procedures were used in this study. Detailed field surveys were made of all cross sections below the structures. Original surveys used in planning of the structures were also used.

The SCS computer Model, WSP2, was used to develop the hydraulic characteristics of the valley downstream of the structures. This model develops a series of water surface profiles, defining the stage-discharge relationship throughout the valley.

The hydrology of the watershed was developed using the Unit Hydrograph method contained in the SCS Model TR-20, Hydrology.

The methodology presented in the SCS Technical Release TR-66 was used in the breach analysis of each dam. A 100-year, 24-hour storm was used in the breach analysis.

The maps show the impacts of: the breach of Structure No. 1 alone, the breach of Structure No. 2 alone, as well as the 100-year rain.

FLOOD PROBLEMS

The objective of the study was to determine and describe the potential flood impact areas below the two constructed SCS dams. Both of these dams are within the city limits of Madisonville. Attached maps show the impacts of the breach routings. Table 1 gives the structural data for the two structures.

The potential impact areas provide a basis for the sponsors to limit future liability. The city of Madisonville may also prepare emergency action plans.

Development has taken place downstream on Town Branch below the watershed structures. Commercial buildings as well as residential homes have been built. Although of low probability, a breach of either of the dams would flood many houses and businesses.

This study provides the information needed by the sponsors to take steps to avoid a major catastrophe if a structure should breach.

Tributaries to Town Branch Creek flow through the present city limit of Madisonville. Texas State Highway 75, a major northwest-southeast traffic artery, intersects Town Branch Creek in the city of Madisonville. Texas State Highway 21, a major southwest-northeast traffic artery, crosses Town Branch Creek in the city of Madisonville.

The city of Madisonville experienced frequent flooding along both Highway 75 and Highway 21 from Town Branch and tributaries prior to watershed completion.

The city of Madisonville is presently in the emergency flood insurance program; however, no previous detailed flood insurance study has been made.

The flood plain management study accurately defines the existing flood hazard areas so the people of Madisonville cam implement land use and development programs consistent with the identified flood hazards.

Potential flood heights for the 100-year and 500-year floods photographed at two locations to illustrate the flood problems are shown on page 10, Figures 1 and 2.

Following is a tabulation of the acreages of rural and urban areas subject to inundation by the 100-year and 500-year floods.

Table 1

FLOODED AREAS

CITY OF MADISONVILLE

FLOOD PLAIN MANAGEMENT STUDY

	Rural (Acres)	Urban (Acres)	Total (Acres)
Within the 100-vear frequency flood plain	6	164	170
Within the 500-year frequency flood plain	8	185	193

Upstream flood plain and watershed land use changes anticipated by local officials within the next 10 to 15 years are not expected to significantly affect future elevations on the flood plains of the study area.

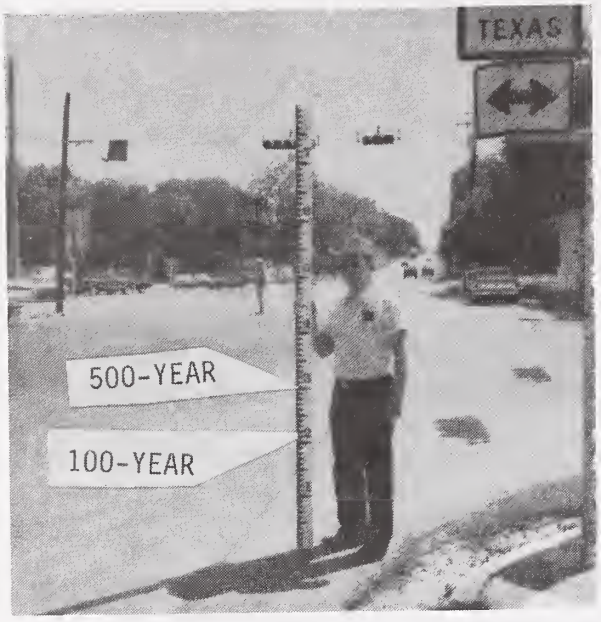
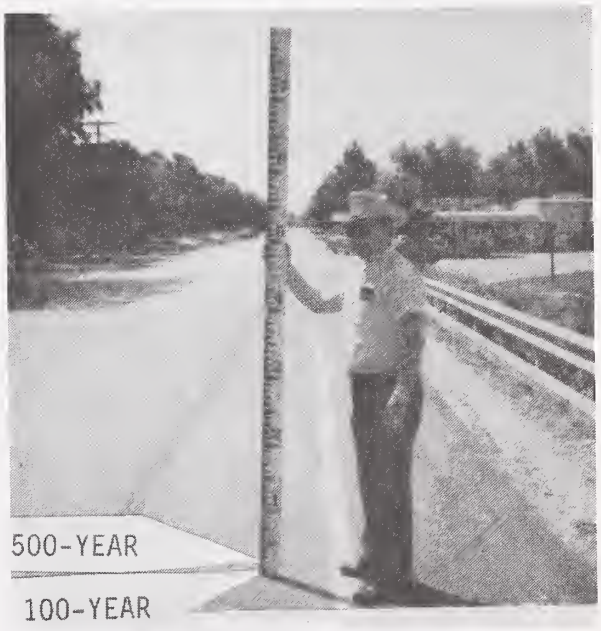


Figure 1 - Potential flood heights at intersection of SH 75 and SH 90.

Figure 2 - Potential flood heights at intersection of Town Branch and Madison Street.



EXISTING FLOOD PLAIN MANAGEMENT

The 61st Texas Legislature in 1969 enacted the Texas Flood Control and Insurance Act, Article 8280-13 VACS, and Article 1581e-1 VACS. Article 8280-13 named the Texas Water Development Board and the State Board of Insurance as the responsible state-level agencies in respect to the National Flood Insurance Program. In 1985, the 69th Texas Legislature created the Texas Water Development Board and the Texas Water Commission from the Texas Department of Water Resources. Article 8280-13 was codified in Texas Water Code (Subchapter I, Section 16.311), and responsibility for the flood insurance program in Texas was assigned to the Texas Water Commission and the State Board of Insurance. Subchapter I, Section 16.315 of the Code authorizes all political subdivisions, including cities, counties, and many types of special purpose districts and authorities, to take all necessary and reasonable actions to comply with the requirements and criteria of the National Flood Insurance Program.

At the present time, state-level statuatory controls on use and management of flood hazard areas are fairly limited. Subchapter G, Section 16.236 of the Texas Water Code, requires the Texas Water Commission or the local political entity to approve plans for any levee or other such improvement which may change floodflows of any stream in Texas that is subject to floods. This state program will utilize state agency rules and regulations calling for evaluation of flood hazards and will conform to the minimum flood plain management criteria established by the
U. S. Department of Housing and Urban Development for the National Flood Insurance Program.

ALTERNATIVES FOR FLOOD PLAIN MANAGEMENT

PRESENT CONDITIONS

Two floodwater retarding structures were built within the city limits of the city of Madisonville. These provide excellent protection. Both commercial and residential development have taken place below the structures. Some shallow flooding will occur from the 100 year frequency storm. Major flooding would occur from a breach of either of the structures especially Site 1 on Town Branch.

LAND TREATMENT

Effective conservation land treatment is presently being carried out by land users in the watershed. Excess runoff or erosion and sedimentation due to lack of conservation land treatment is not a major cause of flooding.

PRESERVATION AND RESTORATION OF NATURAL VALUES

Since the primary natural value of the study area flood plain is its ability to transport floodwaters, encroachment onto the flood hazard areas of the flood plain with obstacles which interfere with the movement of floodwater should be avoided to preserve its present flowage capacity.

Nonprime farmland soils should be used for construction sites and other non-farm uses rather than prime farmland. Information on prime farmland soils in the study area may be obtained from the Soil Conservation Service Office at Madisonville, Texas.

NONSTRUCTURAL MEASURES

Nonstructural measures which will help reduce or minimize flood losses include flood proofing, flood warning systems, relocation, zoning regulations, participation in the national flood insurance program, emergency preparedness, and building or development codes.

Flood proofing can reduce flood damages by a combination of structural provisions and changes or adjustments to properties subject to flooding. Examples of flood proofing are sealing low window and door openings and modifying floor drains to prevent the entrance of flood waters.

Flood warning systems should be coordinated with local disaster plans. The National Weather Service issues warnings of potential flood producing storms. Staff gages set at key locations can be monitored to give advance warnings. A float-activated electronic signal could be connected to the local police or fire station for monitoring.

Relocation involves permanent evacuation of developed areas subject to inundation, acquisition of lands by purchase, removal of improvements and relocation of the population from such areas. Such lands could be used for parks or other purposes that would not suffer large damages and would not interfere with floodflows.

Zoning is a legal method used to implement and enforce the details of the flood plain management program, to preserve property values, and to achieve the most appropriate and beneficial use of available land. Clear, concise, and thorough zoning bylaws with enforcement of the bylaws are essential to make zoning effective.

Flood insurance was established by the National Flood Insurance Act of 1968 (Public Law 90-448, as amended) to make limited amounts of flood insurance, which were previously unavailable from private insurers, available to property owners and occupiers. The Flood Disaster Protection Act of 1973 (Public Law 93-234, as amended) was a major expansion of the National Flood Insurance Program.

Flood insurance is available through local insurance agents and brokers only after a local governing body applies and is declared eligible for the program by the Federal Insurance and Hazard Mitigation Division of the Federal Emergency Management Agency (FEMA). Adoption and enforcement of a local flood prevention ordinance which meets FEMA minimum flood plain management criteria is necessary to qualify and maintain eligibility.

Emergency preparedness consists of a plan by local officials to be put into effect in the event of flooding. Procedures are worked out and personnel designated to implement the plan. Methods and procedures to alert and warn the populace of possible flooding are developed. High risk areas and handicapped elderly or other persons known to need help during evacuation are located and identified. Plans are made for their evacuation or rescue. Shelters are provided for evacuees.

Building codes are developed to set up minimum standards for controlling the design, construction and quality of materials used in buildings and structures within a given area to provide safety for life, health, property and public welfare. Building codes can be used to minimize structural and subsequent damages resulting from inundation. Building restriction codes can:

1. Specify adequate anchorage to prevent flotation of buildings from their foundations.

2. Establish basement elevations and minimum first-floor elevations in accordance with potential flood heights.

3. Prevent virtually all damage by elevating the foundation and prohibiting basements in those areas subject to very shallow and frequent flooding.

4. Require building reinforcement to withstand water pressure or high velocity flow and restrict the use of materials which deteriorate rapidly in the presence of water.

5. Prohibit equipment that might be hazardous to life when submerged. This includes chemical storage, boilers, and electrical equipment.

Development policies which are designed to prevent construction of streets and utility systems in flood prone areas tend to slow development of the flood plains.

FLOOD HAZARD MAPS

The index map (Appendix, page 7) shows the stream reach covered by each of the photomaps. The index map also shows the watershed boundaries and stream reaches studied.

The limits of the 100-year and 500-year floods, for present conditions, were delineated on aerial photographs (Appendix, page 9 to 13) to indicate the area inundated. The 10-year and 50-year frequency floods for present conditions could not be effectively shown on the aerial photographs due to the map scale and topography. The flood lines shown are based on field surveys of roads, bridges, and valley sections used in conjunction with Geological Survey topographic maps having 5-foot contour intervals, and interpretation of aerial photographs. These maps should only be used to determine the approximate boundaries of the flooded areas. Actual dimensions measured on the ground may vary slightly from those measured on the photomaps of this report due to map scale and reproduction limitations. The water surface profile elevations should be used to determine actual on the ground dimensions.

The limits of the structure breaches were also determined. The areas affected by a breach of each of the structures are shown on aerial photographs (Appendix pages 15 to 25).

Analyses were made without showing the effects of potential obstructions. Debris may collect at bridges and culverts and clog the channels during major floods and increase the depth of flooding. Also, extremely rare events such as catastrophic storms were not analyzed.

TECHNICAL APPENDIX

A technical appendix is included in this report. The index map, flood hazard area photomaps, and flood profiles are included in the appendix. The index map shows the study area coverage of individual flood hazard area maps and the watershed boundaries (Appendix, page 7).

The water surface profiles of Town Branch show the profiles of the 10-year, 50-year, 100-year, and 500-year floods for present conditions. Included on the profiles are stream elevations of the channel bottom, pertinent bridge and roadway data, and other location data. The stationing of profile is bank-full stream channel distance, in feet, and is measured from the 1980 flight of aerial photomaps. Flood depths can be estimated at any location on the stream reach from the water surface profiles. The water surface profiles of Town Branch are included in the Appendix, page 8 to 22. An index is included in the Appendix, page 5 to assist the user in relating the flood hazard area photomaps to the appropriate water surface profile.

Cross sections, representative of the streams studied, have been plotted to illustrate the shape of that stream and its flood plain. The 10-year, 50-year, 100-year, and 500-year floodwater surface elevations are shown on the plotted cross section to illustrate the effect of various flood depths (see Appendix, page 24).

The elevations, discharges and flood plain width of the 10-year, 50-year, 100-year and 500-year floods at surveyed cross sections are shown in Appendix Table 2. Each cross section is listed by number on this table. Each cross section is also identified by number on flood hazard area photomaps. The user can locate a cross section on the photomap, turn to Table 2, (Appendix, page 26) and read the discharge, elevation, and flood plain width directly from the table.

Also, included in the Appendix is a list of elevation reference marks showing the elevation and location of each. Additional data are on file in the USDA Soil Conservation Service State Office, W. R. Poage Federal Building, 101 South Main Street, Temple, Texas 76501-7682.

TABLE 1 - STRUCTURE DATA - FLOODWATER RETARDING STRUCTURE AND MULTIPLE-PURPOSE STRUCTURE

Town Branch Watershed, Texas

Item	Unit	STRUCTURE NUMBER 1	STRUCTURE NUMBER 2	Total
Drainage Area	Sq. Mi.	1.07	0.25	1.32
Storage Capacity				
Sediment Pool	Ac. Ft.	7	11	18
Sediment in Fish and Wildlife Pool	Ac. Ft.	18	xx	18
Sediment in Detention Pool	Ac. Ft.	3	1	4
Floodwater	Ac. Ft.	673	157	830
Fish and Wildlife	Ac. Ft.	400	xx	400
Total	Ac. Ft.	1,101	169	1,270
Surface Area				
Sediment Pool 1/	Acre	4	4	8
Floodwater Pool	Acre	130	23	153
Fish and Wildlife	Acre	75	xx	75
Volume of Fill	Cu. Yd.	143,000	57,000	200,000
Elevation Top of Dam	Foot	296.3	294.5	xxx
Maximum Height of Dam 2/	Foot	35	31	xxx
Emergency Spillway				
Crest Elevation	Foot	291.5	290.0	xxx
Bottom Width	Foot	80	70	xxx
Type	-	Veg.	Veg.	xxx
Percent Chance of Use 3/	-	1	1	xxx
Average Curve No. Condition II	-	82	82	xxx
Emergency Spillway Hydrograph				
Storm Rainfall (6-hour) 4/	Inch	14.50	14.96	xxx
Storm Runoff	Inch	12.01	12.47	xxx
Velocity of Flow (Vc) 5/	Ft./Sec.	1.33	1.35	xxx
Discharge Rate 6/	c.f.s.	85	140	xxx
Maximum Water Surface Elevation 6/	Foot	292.4	291.2	xxx
Freeboard Hydrograph				
Storm Rainfall (6-hour) 7/	Inch	36.30	37.40	xxx
Storm Runoff	Inch	33.63	34.73	xxx
Velocity of Flow (VC) 8/	Ft./Sec.	9.4	9.0	xxx
Discharge Rate 6/	c.f.s.	2,065	1,635	xxx
Maximum Water Surface Elevation 6/	Foot	296.3	294.5	xxx
Principal Spillway Capacity (Maximum)	c.f.s.	15	5	xxx
Capacity Equivalents				
Sediment Volume	Inch	0.13	0.80	xxx
Sediment in Fish and Wildlife Pool	Inch	0.32	xx	xxx
Sediment in Detention Pool	Inch	0.05	0.10	xxx
Detention Volume	Inch	11.80	11.75	xxx
Fish and Wildlife Volume ••	Inch	7.00	xx	xxx
Spillway Storage 9/	Inch	13.10	9.75	xxx
Class of Structure	-	C	C	xxx

1/ Surface area to the top of the riser.

2/ Difference in elevation between the top of the settled dam and the bottom of the stream channel.

3/ Is the average number of times the emergency spillway will be expected to function in 100 years based on a regional analysis of gaged runoff.

4/ For Class C Structures, 1.0 x P of the 6-hour rainfall shown by Figure 3.21-1, NEH-4, Supplement A.

5/ Where velocity is shown it was obtained from the formula $V=\frac{Q}{A}$ and was determined from the routed Hp and Q. Critical velocity was not attained by any of the routings of the emergency spillway hydrograph due to little or no flow.

6/ Values obtained from routing.

7/ For Class C structures 2.50 x P for 6-hour rainfall shown on figure 3.21-1, HEH, Section 4, Supplement A.

8/ Obtained from curves drawn from Figure 4-R-11472 revised 3-59 and ES 98 dated 4-27-55, based on flows obtained from graphical routing of the Freeboard Hydrograph.

9/ Watershed inches stored between the emergency spillway crest and the top of the settled dam.

GLOSSARY

Breach - A break in the embankment which causes a sudden release of water stored in the reservoir.

Channel - A natural stream that conveys water; a ditch or channel excavated for the flow of water.

Channel Bottom - The elevation of the deepest part of a stream channel at a particular cross section.

Flood - An overflow or inundation that comes from a river or other body of water and causes or threatens damage.

Flood Frequency - A means of expressing the probability of flood occurrences as determined from a statistical analysis of representative stream flow or rainfall and runoff records. A 10-year flood occurs, on the average, once in 10 years (a ten percent chance of being exceeded in any given year). A 50-year flood occurs, on average, once in 50 years (a two percent chance of being exceeded in any given year). A 100-year flood occurs, on the average, once in 100 years (a one percent chance of being exceeded in any given year). A 500-year flood occurs, on the average, once in 500 years (0.2 percent chance of being exceeded in any given year).

Flood Peak - The highest value of the stage or discharge attained by a flood, thus, peak stage or peak discharge.

Flood Plain - 1. Nearly level land situated on either or both sides of a channel which is subject to overflow flooding. 2. Lowland and relatively flat alluvial areas adjoining inland and coastal waters (streams, bays, etc.), including flood-prone areas of off-shore islands.

500-Year Flood Plain - The land that would be flooded on an average of once every 500 years.

100-Year Flood Plain - The land that would be flooded on an average of once every 100 years.

Flood Stage - The stage at which overflow of the natural banks of a stream causes damage in the reach in which the elevation is measured.

Runoff - That portion of the precipitation on a drainage area that is discharged from the area in stream channels; types include surface runoff, groundwater runoff, or seepage.

Water Surface Profile - A graph showing the relationship of water surface elevation to stream channel location for a specific flood event.

Watershed - All land and water within the confines of a drainage divide.

Watershed Boundary - The divide separating one drainage basin from another.

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APPENDIX

APPENDIX

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TECHNICAL APPENDIX

This Technical Appendix to the City of Madisonville Flood Plain Management Study (FPMS) and Dam Breach Analysis is a compilation of the FPMS technical findings. It includes the photomap index, flood hazard and breach inundation photomaps, flood profiles, plottings of typical stream cross sections, elevation and discharge tabulations and a listing of pertinent elevation reference marks. Other technical data developed during this study are on file in the USDA Soil Conservation Service State Office, W. R. Poage Federal Building, 101 South Main Street, Temple, Texas 76501-7682.

INVESTIGATIONS AND ANALYSES

FIELD SURVEYS

Topographic data were obtained from Geological Survey topographic maps and field surveys. Engineering surveys were made of cross sections selected to represent the stream hydraulics and flood plain areas (refer to the sheets of typical valley cross section, Appendix page 24). Elevations appearing in this report are based on mean National Geodetic Vertical Datum of 1929. Temporary elevation reference marks were established by the Soil Conservation Service in 1986. Table 3 Appendix, pages 29 to 30, shows the listings, descriptions, and location of permanent and temporary elevation reference marks.

HYDROLOGIC AND HYDRAULIC METHODS

The watershed boundaries were determined by use of Geological Survey topographic maps. The top of the watershed begins approximately 1.5 miles north of the Madisonville city limits. Hydraulic evaluations were based on synthetic frequency methods. Rainfall frequency data were obtained from Weather Bureau Technical Paper No. 40, Rainfall Frequency Atlas of the United States. Values greater than the 100-year frequency event were determined by extrapolation of the rainfall versus frequency graph. Peak discharge values were determined by flood routing various storm frequencies with a 24-hour rainfall duration using SCS Technical Release No. 20, A Computer Program for Project Formulation, Hydrology. The program computes surface runoff resulting from any synthetic or natural rainstorm. The program will route the flow through stream channels and reservoirs. Results include, but are not limited to, a combination of the routed hydrograph with those from other tributaries and a printout of the peak discharges, their time of occurrence, and the water surface elevations for each computed discharge at any desired cross section or structure.

From the representative stream and road cross sections, water surface profiles were developed by the Modified Slope Area Method. The effects of bridges and culverts on the stream hydraulics were determined by use of the Bureau of Public Roads (BPR) Method. Computations were made using SCS's "WSP2, A Computer Program for Determining Flood Elevations and Flood Areas for Certain Flow Rates."

Using the output data from this program, rating curves were plotted for each cross section. These curves show the relationship between stage or elevation and discharge. Water surface profiles were developed from these rating curves and the computer results of TR-20 routings.

FLOOD HAZARD EVALUATION

The 500-year and 100-year flood hazard areas are outlined on aerial photographs obtained from the January 1980 Agricultural Conservation and Stabilization Service flight. The flood hazard area boundaries were developed by plotting the computed water surface elevations on the surveyed cross sections and transposing this information to the aerial photographs. The flood hazard areas between the surveyed cross sections were developed through interpretation of Geological Survey topographic maps and the aerial photographs in conjunction with the surveyed cross sections. Actual flood limits may vary slightly on the ground from the outlined area on the photomaps due to map scale and reproduction limitations. For this reason, the water surface elevations from the flood profiles should be used for determining site specific potential flood depths.

Breach routings were made of the two existing dams. The inundation of each breach is shown on the aerial photographs.

INVENTORY OF NATURAL VALUES

The natural values of the study area flood plain were determined by the Soil Conservation Service, Basin and Area Planning staff biologist through on-the-ground reconnaissance, interviews of local people and literature search.

PUBLIC PARTICIPATION

The City of Madisonville Flood Plain Management Study Plan of Work was developed through consultation with the local officials and study endorsers.

MANAGEMENT ALTERNATIVES

Nonstructural management alternatives were considered during the flood plain management study and dam safety breach analyses. These were discussed with local public officials and other interested members of the public. Those considered to have merit and worthy of further study for possible implementation were put in the report.

INDEX
TO
TOWN BRANCH AND TRIBUTARY
FLOOD PLAIN MANAGEMENT STUDY
FLOOD HAZARD AREA PHOTOMAPS
AND
WATER SURFACE PROFILES
AND
DAM BREACH STUDY PROFILES

Cross Section Number	Flood Hazard Area Photomap Sheet Number	Water Surface Profile Sheet Number	Dam Breach Study Sheet Number
		TOWN BRANCH	
1	1	1	1, 4
2	1	1	1, 4
3	1, 2	1	1, 4
4	1, 2	1	1, 4
5	1, 2	2	2, 5
6	1, 2	2	2, 5
7	1, 2	2	2, 5
8	1, 2	2	2, 5
9	1, 2	2	2, 5
10	1, 2	2	2, 5
11	2	2	2
12	2	2	2
13	2	2	2
14	2	2	2
15	2	2	2
16	2	2	2
17	2, 3	2	2
18	2, 3	2	2
19	2, 3	2	2
20	2, 3	2	2
21	2, 3	2	2
22	2, 3	2	2
23	2, 3	2	2
24	2, 3	2	2
25	2, 3	2	2

INDEX
TO
TOWN BRANCH AND TRIBUTARY
FLOOD PLAIN MANAGEMENT STUDY
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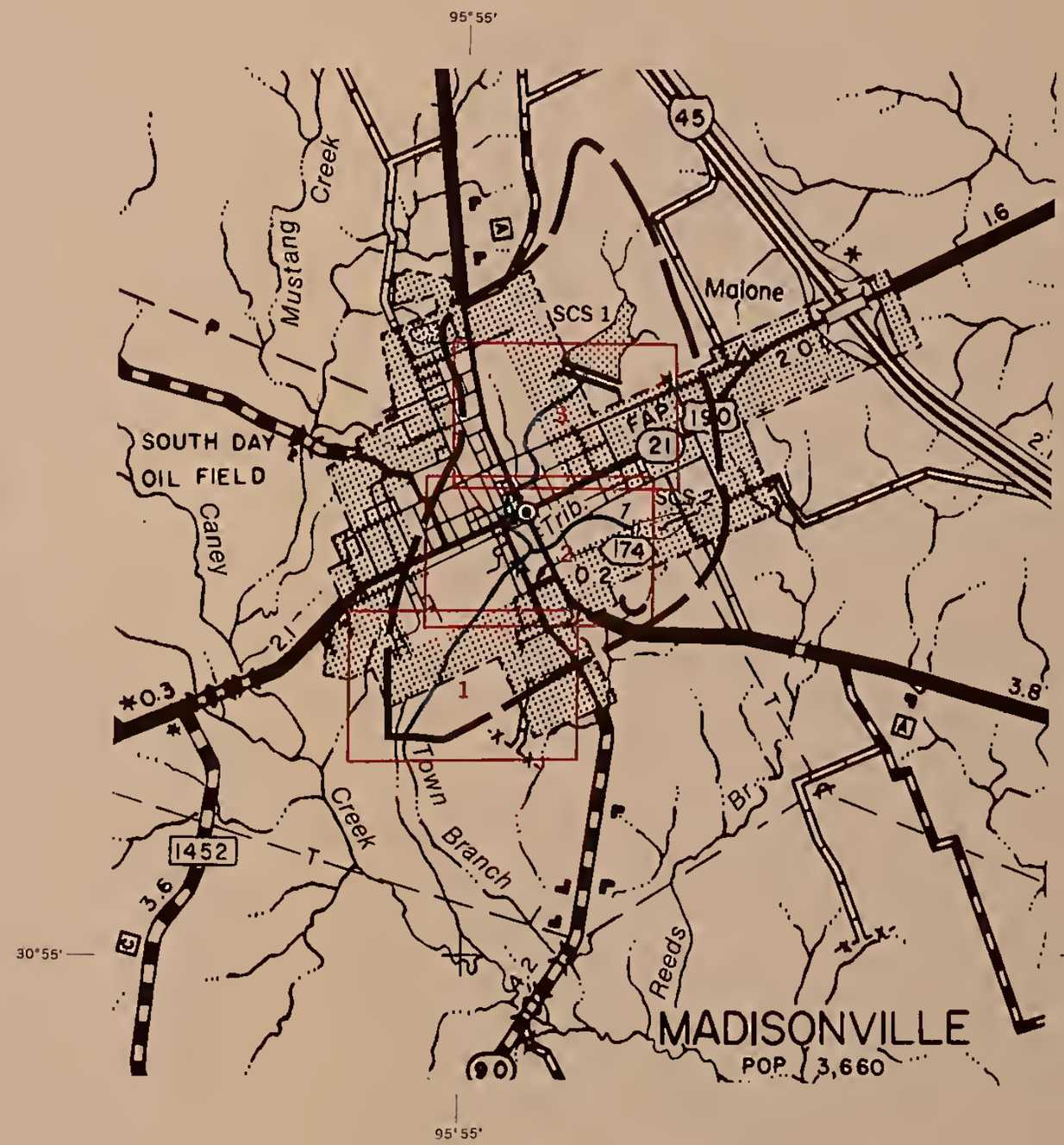
WATER SURFACE PROFILES
AND
DAM BREACH STUDY PROFILES

Cross Section Number	Flood Hazard Area Photomap Sheet Number	Water Surface Profile Sheet Number	Dam Breach Study Sheet Number
	TOWN BRANCH - (cont.)		
26	3	2	2
27	2, 3	3	3
28	2, 3	3	3
29	2, 3	3	3
30	3	3	3
	TOWN BRANCH TRIB. 1		
31	2	4	5
32	2	4	5
33	2	4	5
34	2	4	5
35	2	4	5
36	2	4	5
37	2	4	5
38	2	4	5
39	2	4	5
40	2	4	5
41	2	4	5

U.S. DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE



LEGEND

- CITY LIMIT
- RAILROAD
- STATE HIGHWAY
- FARM TO MARKET ROAD
- WATERSHED BOUNDARY
- STREAM CHANNEL STUDY REACH
- 1 PHOTOMAP COVERAGE

VICINITY MAP

INDEX TO MAP SHEETS
TOWN BRANCH AND TRIBUTARIES
FLOOD PLAIN MANAGEMENT STUDY
MADISON COUNTY, TEXAS

0 1 2
MILES

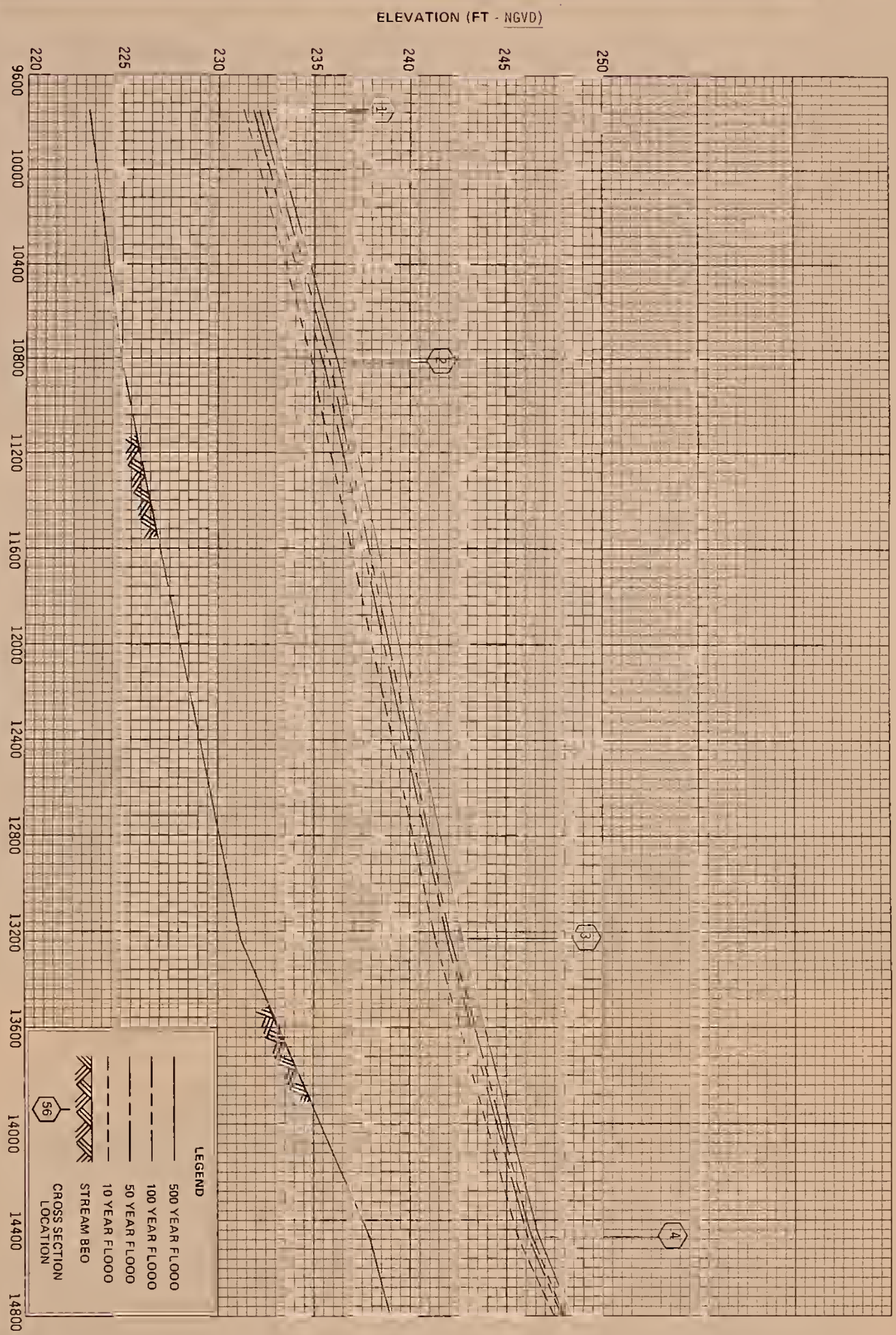
0 1 2
KILOMETERS

SOURCE:
1985 GENERAL HIGHWAY MAP AND
INFORMATION FROM SCS FIELD PERSONNEL.
POLYCONIC PROJECTION.

USDA-SCS-NATIONAL CARTOGRAPHIC CENTER, FT. WORTH, TX-1987

AUGUST 1987 4-R-40081-1

7



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SOIL CONSERVATION SERVICE
TOWN BRANCH & TRIBUTARIES
FLOOD PLAIN MANAGEMENT STUDY
MADISON COUNTY, TEXAS

SHEET 1 OF 4

WATER SURFACE PROFILES

TOWN BRANCH

LEGEND

100 Year Flood Hazard Area
500 Year Flood Hazard Area
Cross Section Location
Stream Channel
Elevation Reference Marks
1500 → Channel Station

Limits of flooding may vary from actual location on the ground.

SCALE 0 400 800 FEET
0 100 200 METERS
APPROXIMATE

1980 ASCS Photography

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
TOWN BRANCH
FLOOD PLAIN MANAGEMENT STUDY AREA
MADISON COUNTY, TEXAS

FLOOD HAZARD AREA

TOWN BRANCH

SHEET 1 OF 3

JANUARY 1987 4-R-40061

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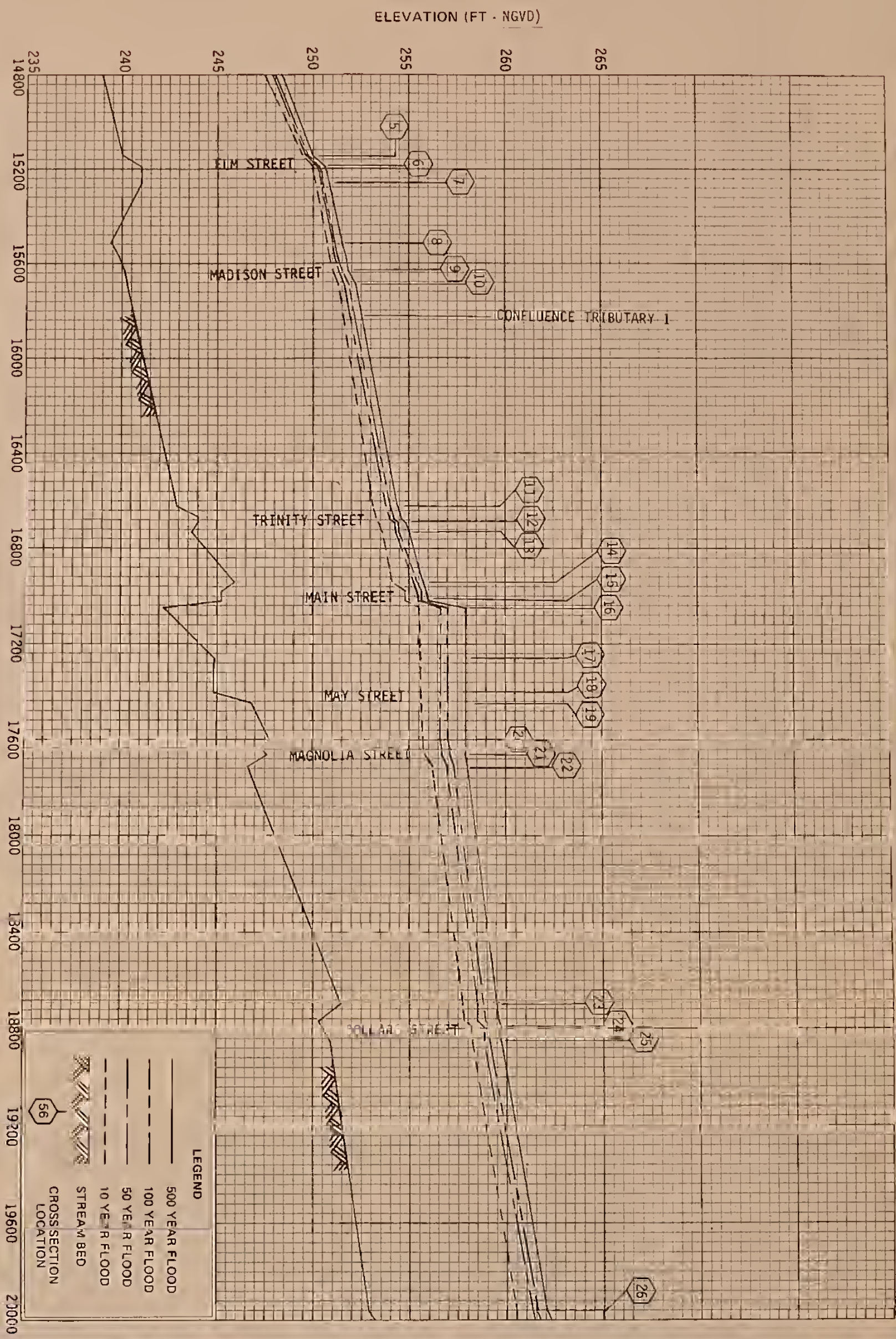

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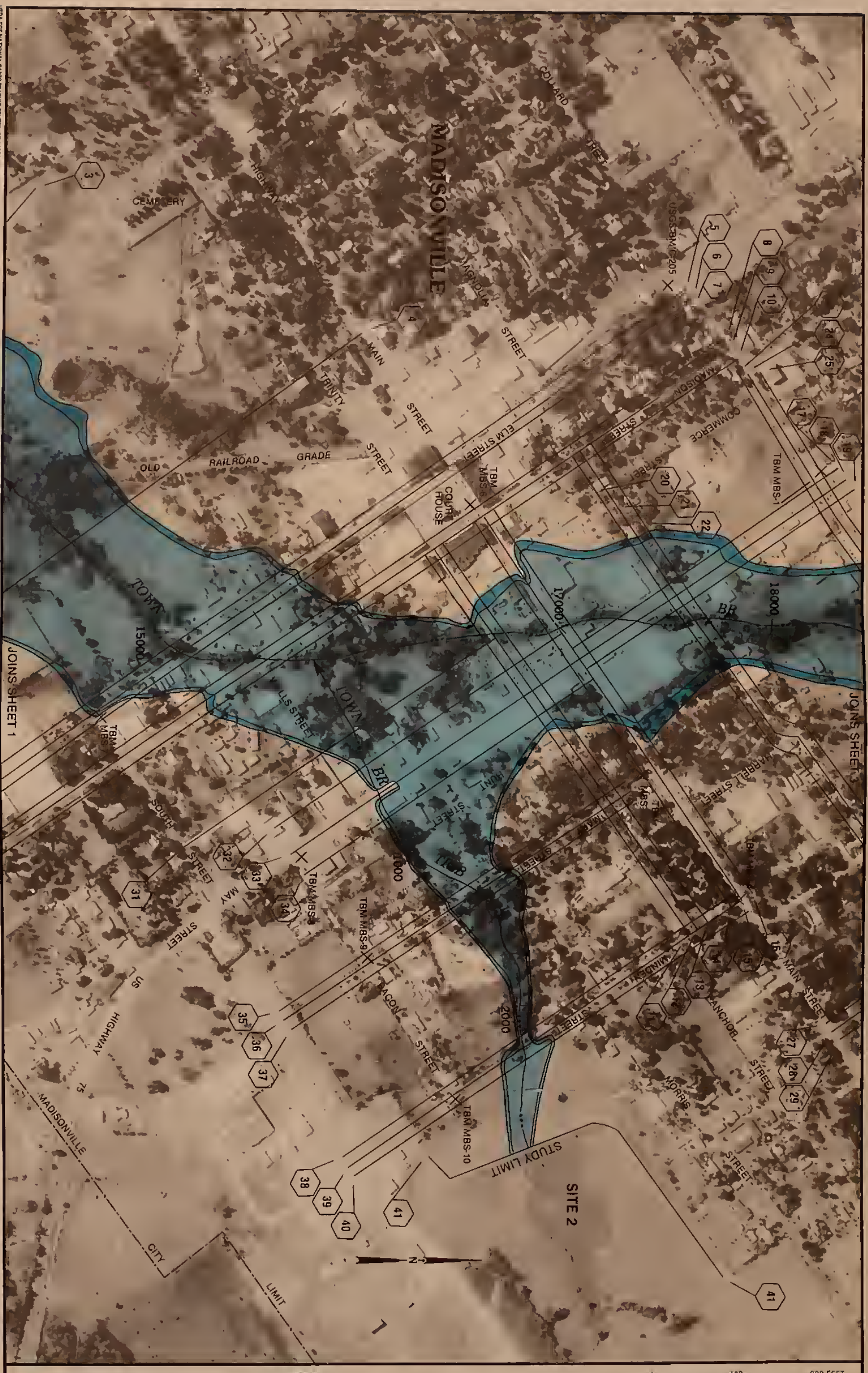
TOWN BRANCH & TRIBUTARIES
FLOOD PLAIN MANAGEMENT STUDY
MADISON COUNTY, TEXAS

WATER SURFACE PROFILES

TOWN BRANCH

SHEET 2 OF 4

10



LEGEND

100 Year Flood Hazard Area
500 Year Flood Hazard Area
Cross Section Location
Stream Channel
Elevation Reference Marks
1500 → Channel Station

Limits of flooding may vary from actual location on the ground.

SCALE 0 400 800 FEET
0 100 200 METERS
APPROXIMATE

1980 ASCS Photography

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
TOWN BRANCH
FLOOD PLAIN MANAGEMENT STUDY AREA
MADISON COUNTY, TEXAS

FLOOD HAZARD AREA

TOWN BRANCH

SHEET 2 OF 3

JANUARY 1987 A R-40081

USDA-SCS-NATIONAL CARTOGRAPHIC CENTER, FT. WORTH, TX-1987

ELEVATION (FT · NGVD)

250 255 260 265 270

20000 20400 20800 21200 21600 22000

240 245 250 255 260 265 270

0 400 800 1200 1600 2000 2400 2800

STATION (FEET)

SHIPP STREET

CONFLUENCE TOWN BRANCH

MAY STREET

MARY STREET

MINDEN ST

STUDY LIMIT

STUDY LIMIT

27 28 29 30 31 32 33 34 35 36 37 38 39 40 41

LEGEND

500 YEAR FLOOD

100 YEAR FLDDD

50 YEAR FLDOD

10 YEAR FLDOD

STREAM BED

56 CROSS SECTION LOCATION

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
TOWN BRANCH & TRIBUTARIES
FLOOD PLAIN MANAGEMENT STUDY
MADISON COUNTY, TEXAS

SHEET 3 OF 4

WATER SURFACE PROFILES

TOWN BRANCH

LEGEND

100 Year Flood Hazard Area
500 Year Flood Hazard Area
Cross Section Location
Stream Channel
Elevation Reference Marks
1500 → Channel Station

Limits of flooding may vary from actual location on the ground.

SCALE 0 400 800 FEET
0 100 200 METERS
APPROXIMATE

1980 ASCS Photography

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
TOWN BRANCH
FLOOD PLAIN MANAGEMENT STUDY AREA
MADISON COUNTY, TEXAS

FLOOD HAZARD AREA

TOWN BRANCH

SHEET 3 OF 3

JANUARY 1987 4-R-40081

USDA-SCS-NATIONAL CARTOGRAPHIC CENTER, FT. WORTH, TX-1987

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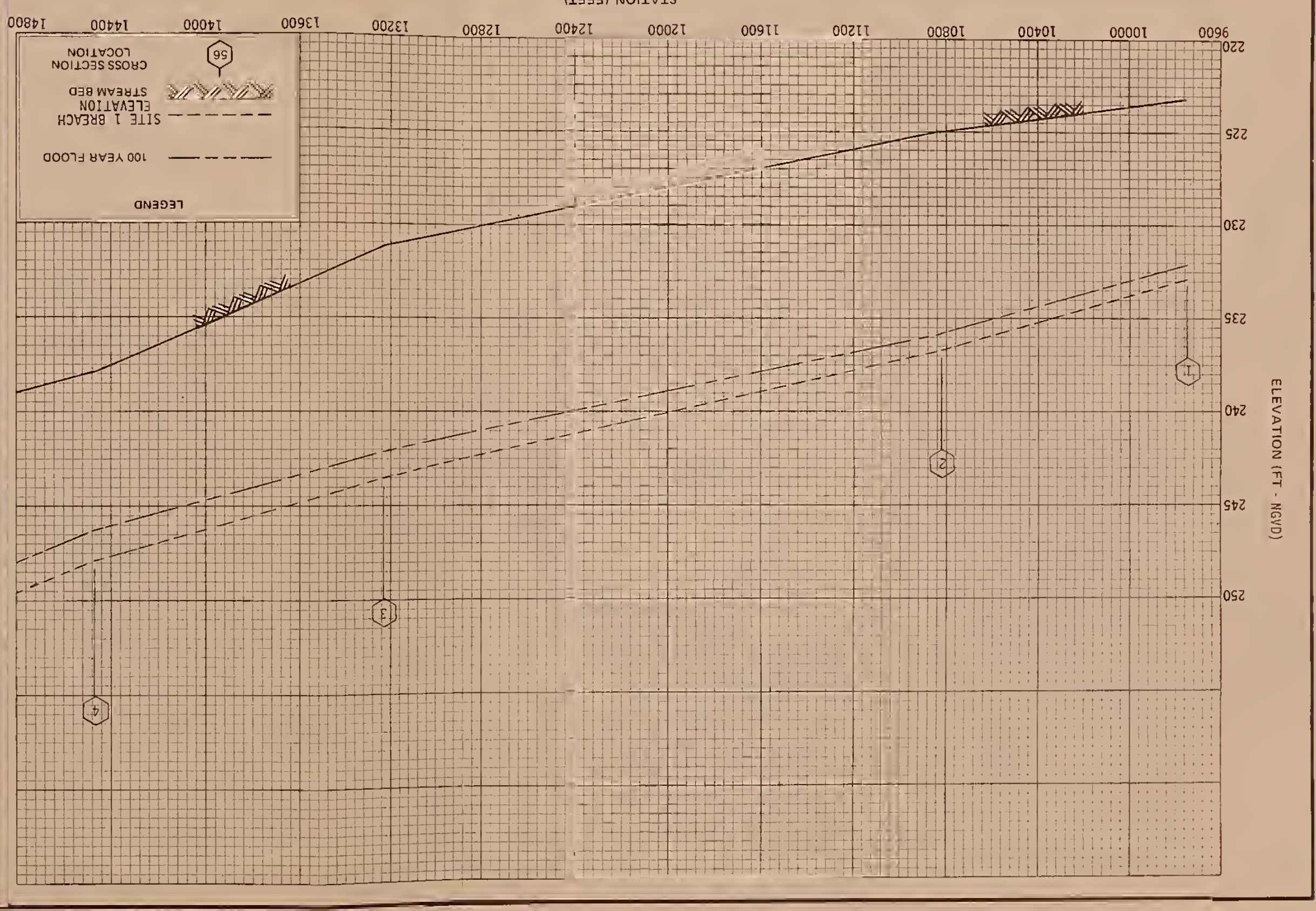
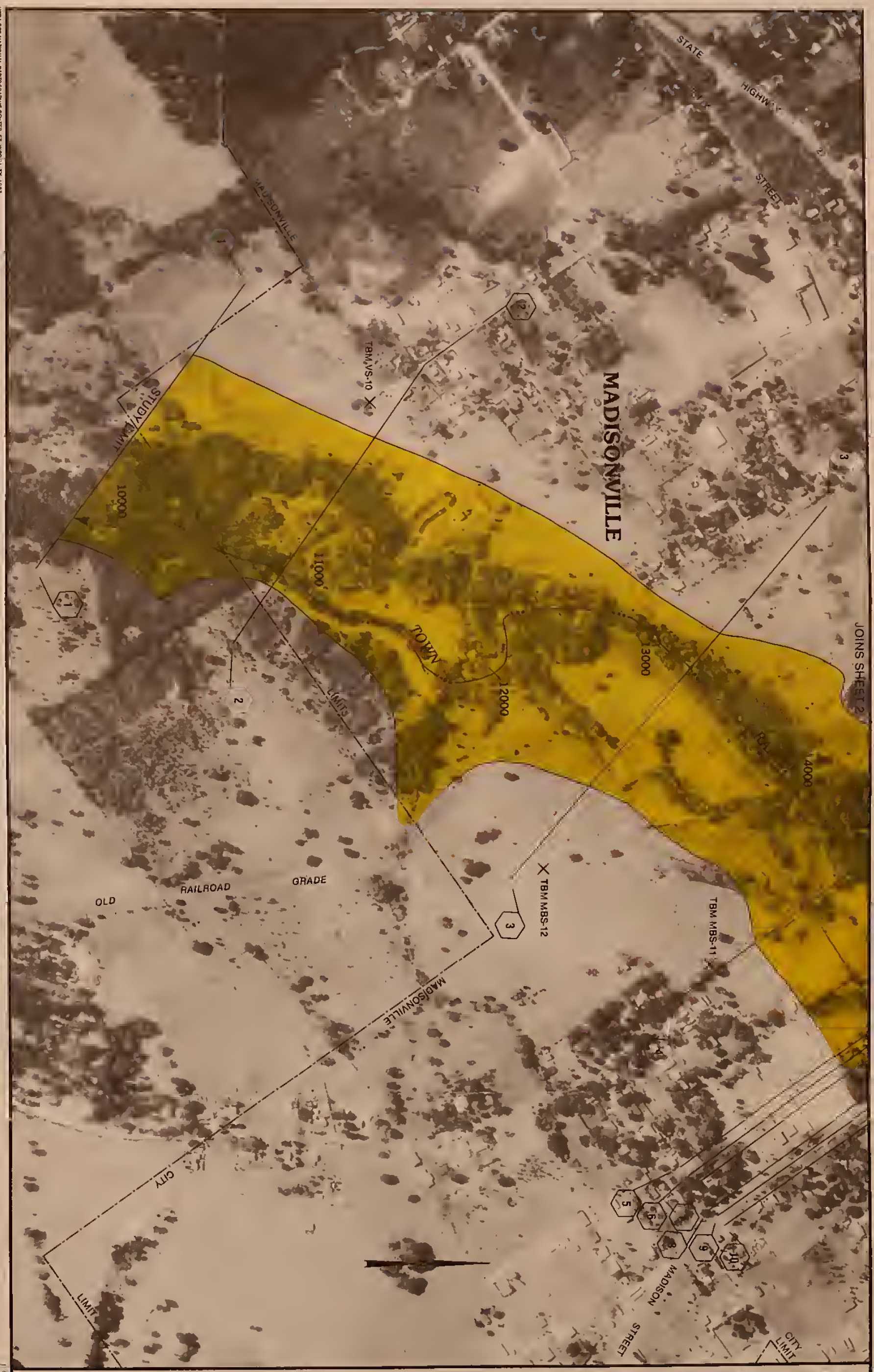
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

TOWN BRANCH & TRIBUTARIES
DAM SAFETY BREACH STUDY
MADISON COUNTY, TEXAS

WATER SURFACE PROFILES

SITE 1 BREACH





LEGEND

Site 1 Breach Inundation Area

Cross Section Location

Stream Channel

Elevation Reference Marks

1500 → Channel Station

Limits of flooding may vary from actual location on the ground.

SCALE 0 400 800 FEET

0 100 200 METERS APPROXIMATE

1980 ASCS Photography

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
TOWN BRANCH
SITE 1 BREACH STUDY AREA
MADISON COUNTY, TEXAS

SITE 1 INUNDATION AREA

TOWN BRANCH

SHEET 1 OF 3

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ELEVATION (FT - NGVD)

235 240 245 250 255 260 265 270

STATION (FEET)

14800 15200 15600 16000 16400 16800 17200 17600 18000 18400 18800 19200 19600 20000

ELM STREET

MADISON STREET

CONFLUENCE TRIBUTARY 1

TRINITY STREET

MAIN STREET

MAY STREET

MAGNOLIA STREET

COLLARD STREET

5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26

LEGEND

100 YEAR FLOOD

SITE 1 BREACH ELEVATION

STREAM BED

56 CROSS SECTION LOCATION

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
TOWN BRANCH & TRIBUTARIES
DAM SAFETY BREACH STUDY
MADISON COUNTY, TEXAS

WATER SURFACE PROFILES

SITE 1 BREACH

SHEET 2 OF 5

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LEGEND

Site 1 Breach Inundation Area

Cross Section Location

Stream Channel

Elevation Reference Marks

1500 → Channel Station

Limits of flooding may vary from actual location on the ground.

SCALE 0 400 800 FEET
0 100 200 METERS
APPROXIMATE

1980 ASCS Photography

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
TOWN BRANCH
SITE 1 BREACH STUDY AREA
MADISON COUNTY, TEXAS

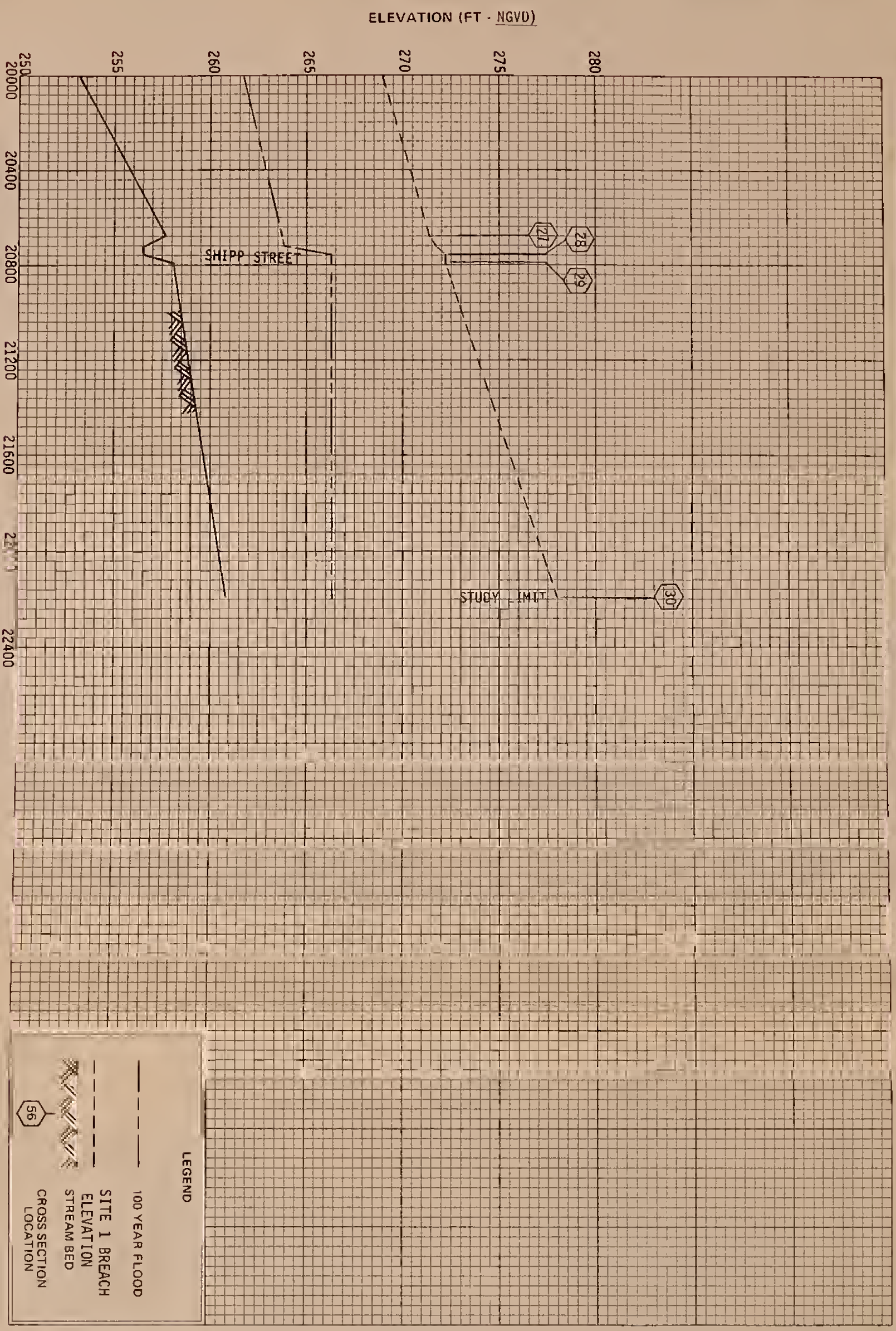
SITE 1 INUNDATION AREA

TOWN BRANCH

SHEET 2 OF 3

JANUARY 1987 4-R-40081

USDA-SCS-NATIONAL CARTOGRAPHIC CENTER, FT. WORTH, TX.-1987



U.S. DEPARTMENT OF AGRICULTURE
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TOWN BRANCH & TRIBUTARIES
DAM SAFETY BREACH STUDY
MADISON COUNTY, TEXAS

WATER SURFACE PROFILES

SITE 1 BREACH

SHEET 3 OF 5

LEGEND

Site 1 Breach Inundation Area

Cross Section Location

Stream Channel

Elevation Reference Marks

1500 → Channel Station

Limits of flooding may vary from actual location on the ground.

SCALE 0 400 800 FEET
0 100 200 METERS
APPROXIMATE

1980 ASCS Photography

U.S. DEPARTMENT OF AGRICULTURE
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TOWN BRANCH
SITE 1 BREACH STUDY AREA
MADISON COUNTY, TEXAS

SITE 1 INUNDATION AREA

TOWN BRANCH

SHEET 3 OF 3

JANUARY 1987 4-R-40081

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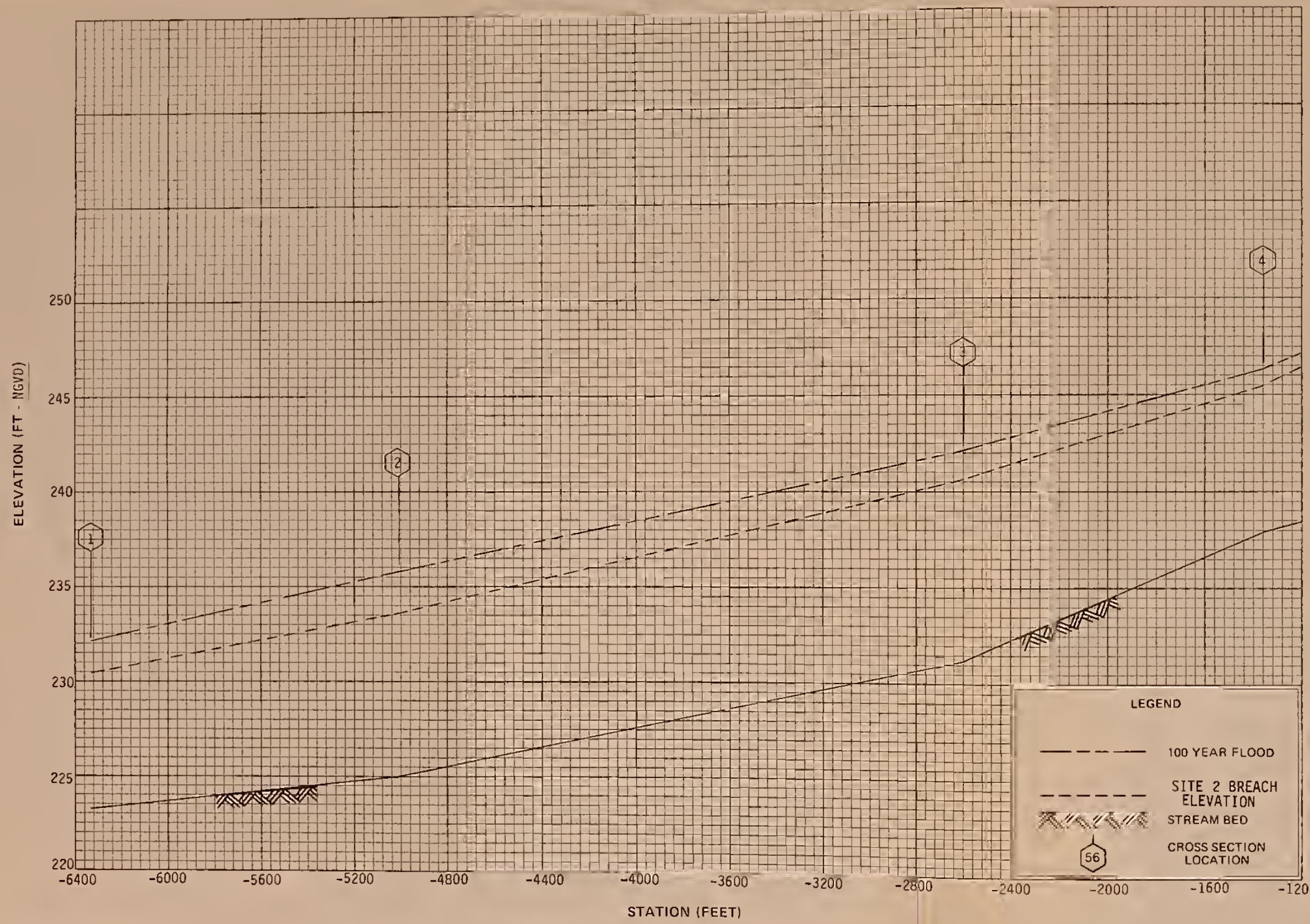
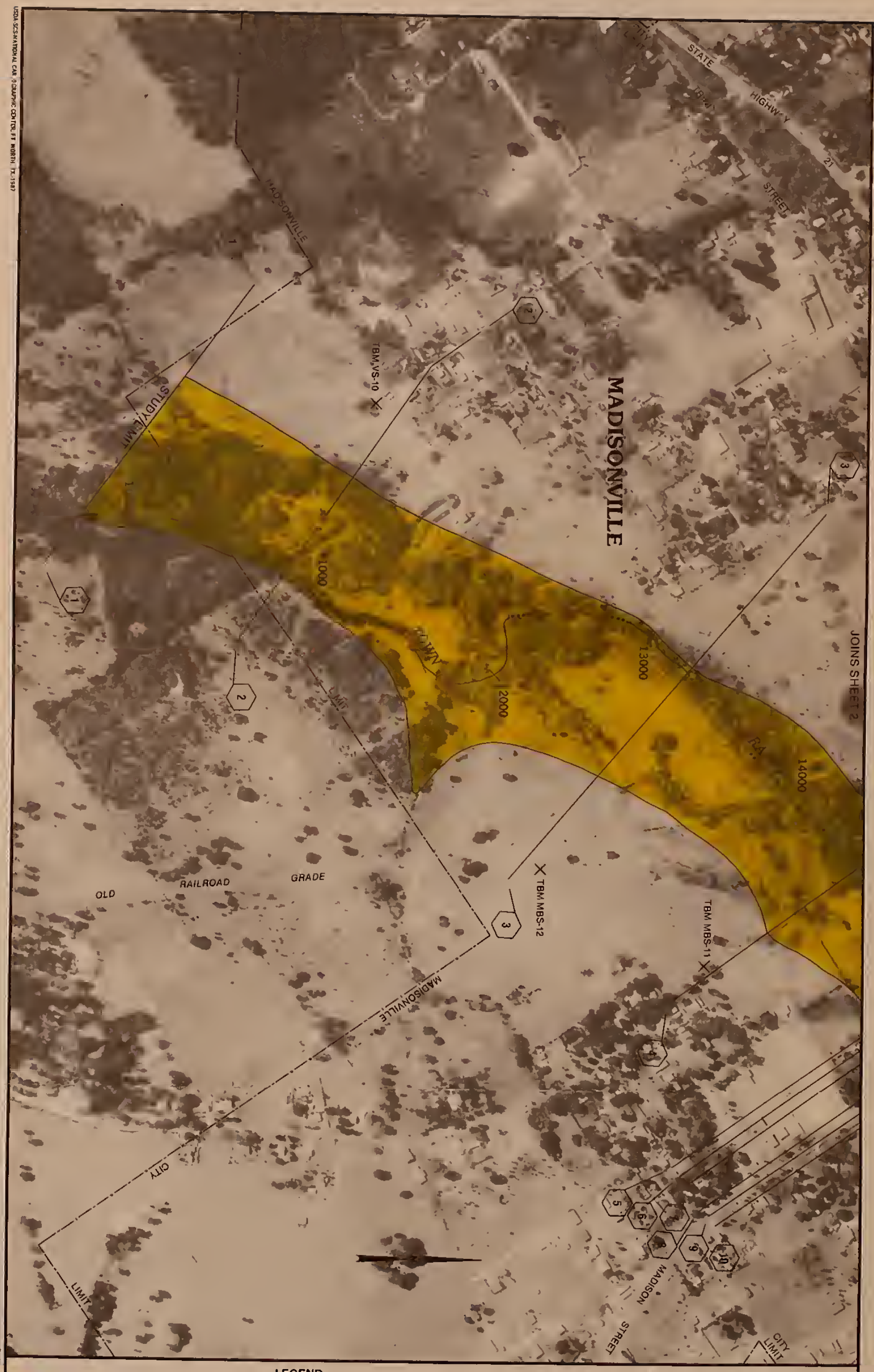


WATER SURFACE PROFILES

SITE 2 BREACH

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
TOWN BRANCH & TRIBUTARIES
DAM SAFETY BREACH STUDY
MADISON COUNTY, TEXAS

SHEET 4 OF 5



LEGEND

Site 2 Breach Inundation Area

Cross Section Location

Stream Channel

Elevation Reference Marks

1500 → Channel Station

Limits of flooding may vary from actual location on the ground.

SCALE 0 400 800 FEET
0 100 200 METERS
APPROXIMATE

1980 ASCS Photography

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
TOWN BRANCH
SITE 2 BREACH STUDY AREA
MADISON COUNTY, TEXAS

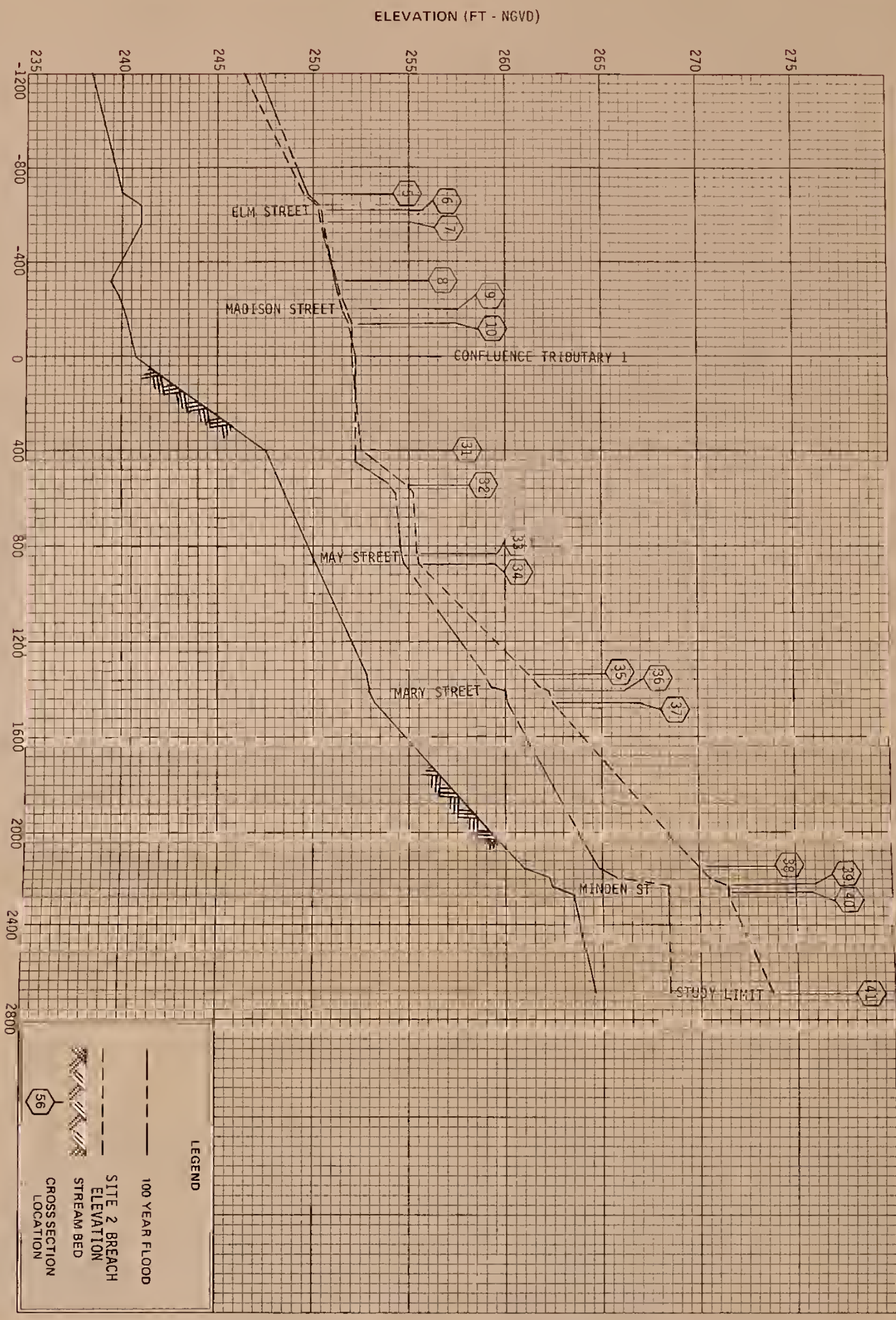
SITE 2 INUNDATION AREA

TOWN BRANCH

SHEET 1 OF 3

JANUARY 1987 4-R-40091

USDA SCS NATIONAL CAR. GRAPHIC CONTROL FT WORTH TX. 1987



U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
TOWN BRANCH & TRIBUTARIES
DAM SAFETY BREACH STUDY
MADISON COUNTY, TEXAS

WATER SURFACE PROFILES

SITE 2 BREACH

SHEET 5 OF 5

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LEGEND

Site 2 Breach Inundation Area

Cross Section Location

Stream Channel

Elevation Reference Marks

1500 → Channel Station

Limits of flooding may vary from actual location on the ground.

SCALE 0 400 800 FEET
0 100 200 METERS
APPROXIMATE

1980 ASCS Photography

USDA-SCS-NATIONAL CARTOGRAPHIC CENTER, FT. WORTH, TX.-1987

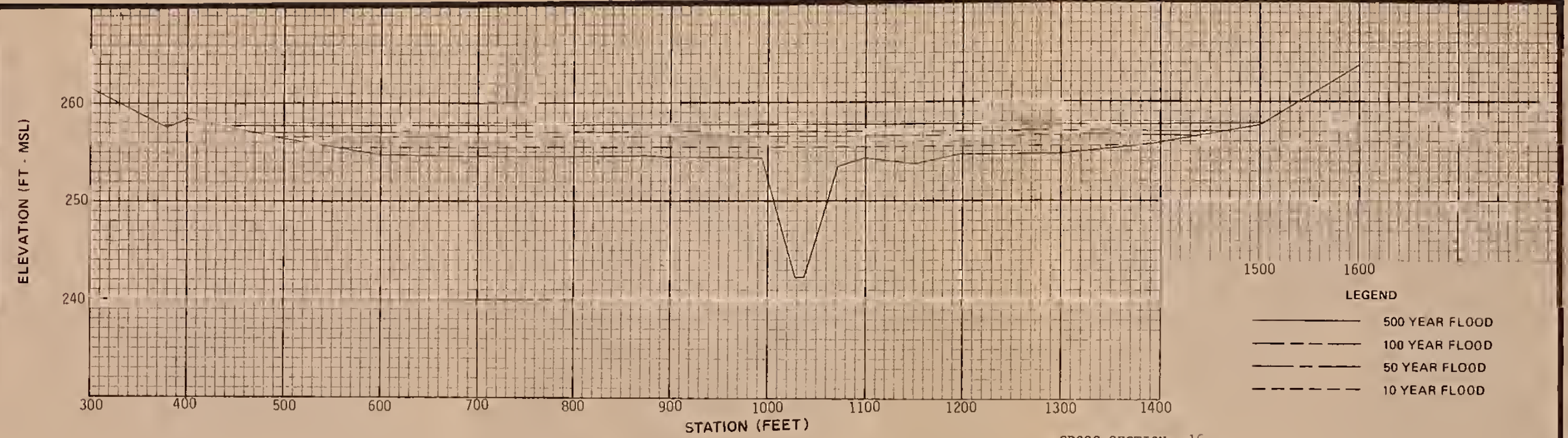
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
TOWN BRANCH
SITE 2 BREACH STUDY AREA
MADISON COUNTY, TEXAS

SHEET 2 OF 3

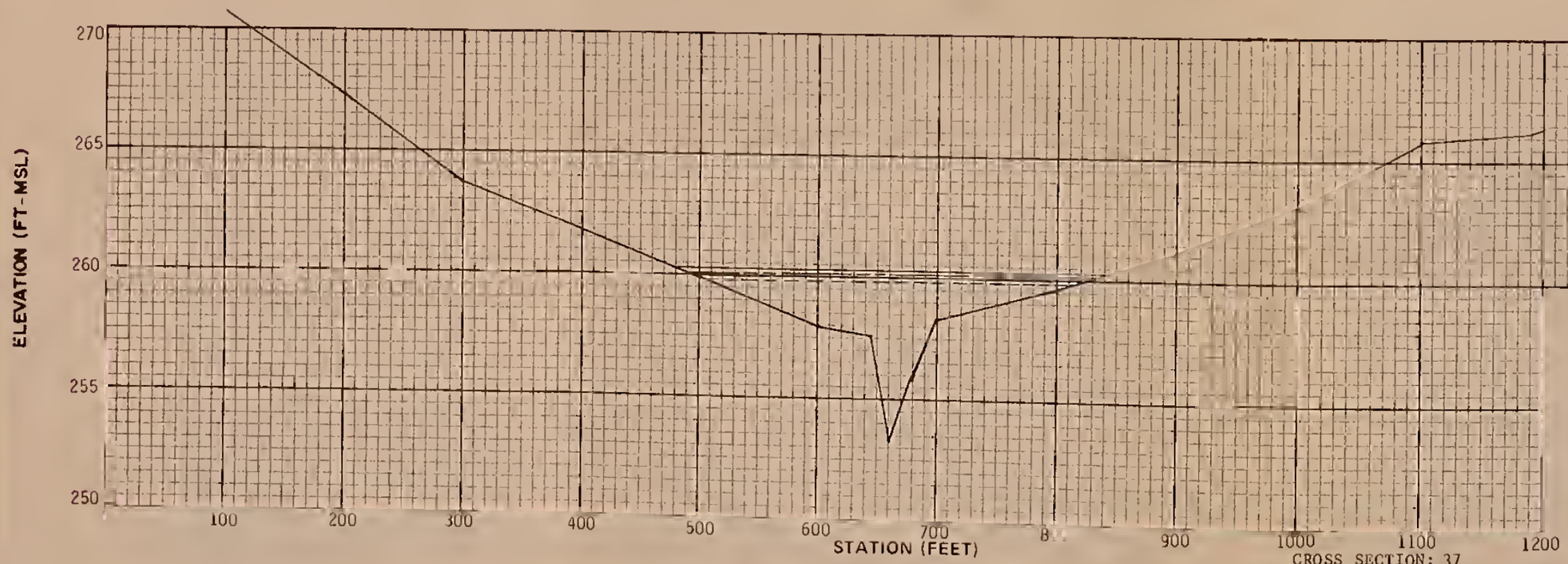
SITE 2 INUNDATION AREA

TOWN BRANCH

JANUARY 1987 4-R-40081



CROSS SECTION: 16
STREAM: TOWN BRANCH



CROSS SECTION: 37
STREAM: TRIBUTARY 1

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

TOWN BRANCH & TRIBUTARIES
FLOOD PLAIN MANAGEMENT STUDY
MADISON COUNTY, TEXAS

TYPICAL VALLEY CROSS SECTIONS

SHEET 1 OF 1

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
TOWN BRANCH
SITE 2 BREACH STUDY AREA
MADISON COUNTY, TEXAS

SITE 2 INUNDATION AREA

TOWN BRANCH

SHEET 3 OF 3

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TABLE 2

TOWN BRANCH FLOOD PLAIN MANAGEMENT STUDY

ELEVATION AND DISCHARGE TABULATIONS

CROSS SECTION NUMBER	10-YEAR DISCHARGE CFS	10-YEAR ELEVATION M.S.L. FEET	10-YEAR FLOOD PLAIN WIDTH FEET	50-YEAR DISCHARGE CFS	50-YEAR ELEVATION M.S.L. FEET	50-YEAR FLOOD PLAIN WIDTH FEET	100-YEAR DISCHARGE CFS	100-YEAR ELEVATION M.S.L. FEET	100-YEAR FLOOD PLAIN WIDTH FEET	500-YEAR DISCHARGE CFS	500-YEAR ELEVATION M.S.L. FEET	500-YEAR FLOOD PLAIN WIDTH FEET
1	1702	231.3	959	2407	231.8	993	2831	232.10	1014	3750	232.50	1040
2	1726	234.90	714	2410	235.50	764	2820	235.80	783	3704	236.20	810
3	1761	241.30	816	2507	241.90	851	2935	242.10	862	3842	242.70	895
4	1632	245.60	808	2239	246.10	868	2589	246.30	896	3312	246.70	954
5	1426	249.40	1072	1932	249.60	1088	2221	249.70	1095	2819	250.00	1119
6	1426	250.00	1076	1932	250.30	1123	2221	250.40	1133	2819	250.70	1161
7	1426	250.10	899	1932	250.40	924	2221	250.50	932	2819	250.80	957
8	1337	250.70	662	1800	251.00	695	2064	251.10	706	2609	251.50	751
10	1337	251.30	657	1800	251.60	769	2064	251.80	805	2609	252.20	867
11	1014	253.10	313	1365	253.80	385	1561	254.00	400	2009	254.40	614
12	1014	253.40	303	1365	254.20	540	1561	254.40	606	2009	254.80	683
13	1014	253.60	341	1365	254.30	639	1561	254.50	672	2009	255.00	756
14	1013	254.60	503	1364	255.20	748	1560	255.40	773	2003	255.70	812

TABLE 2

TOWN BRANCH FLOOD PLAIN MANAGEMENT STUDY

ELEVATION AND DISCHARGE TABULATIONS

CROSS SECTION NUMBER	10-YEAR DISCHARGE CFS	10-YEAR ELEVATION M.S.L. FEET	10-YEAR FLOOD PLAIN WIDTH FEET	50-YEAR DISCHARGE CFS	50-YEAR ELEVATION M.S.L. FEET	50-YEAR FLOOD PLAIN WIDTH FEET	100-YEAR DISCHARGE CFS	100-YEAR ELEVATION M.S.L. FEET	100-YEAR FLOOD PLAIN WIDTH FEET	500-YEAR DISCHARGE CFS	500-YEAR ELEVATION M.S.L. FEET	500-YEAR FLOOD PLAIN WIDTH FEET
16	1013	255.50	799	1364	256.60	943	1560	257.00	985	2003	257.90	1132
17	1004	255.60	1931	1359	256.60	2060	1552	257.00	2097	1962	257.90	2168
19	1004	255.60	1928	1359	256.60	2048	1552	257.00	2090	1962	257.90	2164
20	991	255.70	553	1350	256.60	645	1539	257.00	690	1899	257.90	785
22	991	256.20	614	1350	256.90	671	1539	257.30	703	1899	258.00	759
23	1127	257.70	525	1613	258.50	688	1854	258.80	813	2308	259.50	900
25	1127	258.20	436	1613	258.80	517	1854	259.10	594	2308	259.70	749
26	813	260.50	97	1148	261.30	125	1333	261.60	135	1697	262.10	168
27	758	262.60	90	1068	263.30	94	1242	263.70	96	1589	264.20	98
29	758	266.00	480	1068	266.20	554	1242	266.30	592	1589	266.50	641
30	9	266.00	50	13	266.20	51	15	266.30	52	19	266.50	54
31	552	251.60	1094	780	252.00	1122	880	252.20	1136	1092	252.50	1157

TABLE 2

TOWN BRANCH FLOOD PLAIN MANAGEMENT STUDY

ELEVATION AND DISCHARGE TABULATIONS

CROSS SECTION NUMBER	10-YEAR DISCHARGE CFS	10-YEAR ELEVATION M.S.L. FEET	10-YEAR FLOOD PLAIN WIDTH FEET	50-YEAR DISCHARGE CFS	50-YEAR ELEVATION M.S.L. FEET	50-YEAR FLOOD PLAIN WIDTH FEET	100-YEAR DISCHARGE CFS	100-YEAR ELEVATION M.S.L. FEET	100-YEAR FLOOD PLAIN WIDTH FEET	500-YEAR DISCHARGE CFS	500-YEAR ELEVATION M.S.L. FEET	500-YEAR FLOOD PLAIN WIDTH FEET
32	502	253.50	258	708	253.80	854	808	253.90	862	1013	254.20	899
34	502	254.60	1890	708	254.70	1899	808	254.74	1903	1013	254.80	1909
35	421	258.10	81	593	258.70	212	690	258.90	239	882	259.20	281
36	421	259.10	29	593	259.90	253	690	260.00	289	882	260.20	328
37	421	259.20	227	593	260.00	325	690	260.10	338	882	260.30	361
38	125	264.50	33	171	264.70	41	196	264.80	45	246	265.00	64
40	125	268.26	268	171	268.33	274	196	268.40	280	246	268.50	288
41	5	268.26	113	6	268.33	114	7	268.40	114	9	268.50	116

TABLE 3

BENCH MARK DESCRIPTIONS AND ELEVATIONS

FLOOD PLAIN MANAGEMENT STUDY, DAM SAFETY

BREACH ROUTINGS OF CONSTRUCTED DAMS

TOWN BRANCH AND TRIBUTARIES

MADISON COUNTY, TEXAS

Flood Hazard Area Sheet Number	RM Name	(Ft. MSL)	Description
2	USGS BMC-205	276.39	In the southeast quadrant of Collard Street and Elm Street, in Gulf States utility yard, in the concrete base of old water tower, a standard bronze disk.
2, 3	MBS-1	269.43	Northwest corner of Collard Street and U. S. Highway 75 (May Street) on top of curb, a chiseled square.
3	MBS-2	273.11	In the northeast corner of Collard Street and Shipp Street on the head of a railroad spike.
3	MBS-3	272.86	In the southwest corner of Magnolia Street and Minden Street, in the northeast side of power pole, on the head of a 60d nail.
2	MBS-4	281.95	In the southeast corner of Main Street (Highway 21) and Minden Street. A chiseled "X" on top of curb.
2	MBS-5	262.88	At southwest corner of Main Street (Highway 21) and Mary Street in west side of power pole with light, head of 60d nail.
2	MBS-6	262.10	At northeast corner of Madison County Courthouse in front of John Walker monument, a chiseled square on top of curb.
2	MBS-7	251.16	At northeast corner of Elm Street and South Street, on the north side of a power pole, on the head of a 60d nail.

TABLE 3

BENCH MARK DESCRIPTIONS AND ELEVATIONS

FLOOD PLAIN MANAGEMENT STUDY, DAM SAFETY

BREACH ROUTINGS OF CONSTRUCTED DAMS

TOWN BRANCH AND TRIBUTARIES

MADISON COUNTY, TEXAS

Flood Hazard Area Sheet Number	RM Name	(Ft. MSL)	Description
2	MBS-8	273.85	At the northeast corner of Mary Street and Bacon Street on top of curb, a chiseled "X".
2	MBS-9	271.78	At the northwest corner of Mary Street and Bacon Street on top of bolt on top of fire hydrant.
2	MBS-10	282.04	In front of School Administration Building, in west base of fence corner post, head of a 60d nail.
1	MBS-11	251.41	275 feet northwest of fence corner, 60 feet west of fence, north base of 30-inch diameter post oak tree, top of bent 60d nail.
1	MBS-12	259.55	400 feet southwest of southwest end of tank, 125 feet east of old railroad, in northwest root of 30-inch diameter hackberry tree, on top of bent 60d nail.
1	VS-10	241.81	600 feet southwest of sewer plant, 100 feet southeast of fence corner, in east base of 26-inch post oak tree, on top of bent 60d nail.